

Question
Papers of
Mathematics01
course of
B.C.A.
Programme of
C.C.S.U. Meerut

Namaste readers. How are you?

This PDF (Portable Document Format) format file contains question papers of external examinations of mathematics01 course of first semester of B.C.A. programme of Chaudhary Charan Singh University (C.C.S.U.), Meerut (India) of the years 2016, 2017, 2018, 2019 and 2020.

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BCA-I Sem.

Roll No.

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18005**B. C. A. Examination, Dec. 2016****MATHEMATICS-I****(BCA-101)****(New Course)***Time : Three Hours]**[Maximum Marks : 75*

Note : Attempt questions from all Sections as per instructions.

Section-A**(Very Short Answer Questions)**

Attempt all the *five* questions of this Section.

Each question carries 3 marks. Very short answer is required.

 $3 \times 5 = 15$

1. Show that $A = \begin{bmatrix} ab & b^2 \\ -a^2 & -ab \end{bmatrix}$ is nilpotent matrix of order 2. 3

2. If $y = \log[\log(\log x)]$, find $\frac{dy}{dx}$. 3

3. Evaluate $\int \frac{(a^x - b^x)^2}{a^x b^x} dx$. 3

4. Calculate the area of parallelogram spanned by the vectors $a = (3, -3, 1)$ and $b = (4, 9, 2)$. 3

5. Evaluate $\lim_{n \rightarrow \infty} \frac{\sum n^2}{n^3}$. 3

Section-B**(Short Answer Questions)**

Attempt any *two* questions out of the following three questions. Each question carries $7\frac{1}{2}$ marks.

Short answer is required.

 $7\frac{1}{2} \times 2 = 15$

6. Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$. $7\frac{1}{2}$ (

7. Evaluate $\int \frac{3x+1}{(x-1)^2(x+3)} dx$. $7\frac{1}{2}$

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8. Expand $\sin x$ in power of x and hence find $\sin 18^\circ$ upto four decimal places. 7½

Section-C

(Detailed Answer Questions)

Attempt any *three* questions out of the following five questions. Each question carries 15 marks.
Answer is required in detail. 15×3=45

9. (a) Show that $\lim_{x \rightarrow 0} \frac{e^{1/x} - 1}{e^{1/x} + 1}$ does not exist. 5
- (b) Examine the continuity of the function at the indicated point. Also point out the type of discontinuity, if any : 10

$$f(x) = \begin{cases} \frac{e^{1/x} - e^{-1/x}}{e^{1/x} + e^{-1/x}} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases} \text{ at } x = 0.$$

10. Verify Cayley-Hamilton theorem for the matrix :

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

and hence find A^{-1} . Also state the Cayley-Hamilton theorem. 15

11. Trace the curve $y^2 = (x-1)(x-2)(x-3)$. 15

12. (a) If $I_n = \int_0^{\pi/4} \tan^n x dx$; prove that $I_{n-1} + I_{n+1} = \frac{1}{n}$.

Deduce the value of I_5 . 10

- (b) Evaluate $\int \frac{xe^x}{(x+1)^2} dx$. 5

13. If $y = \sin(m \sin^{-1} x)$, $|x| < 1$; prove that :

(a) $(1-x^2)y_2 - xy_1 + m^2y = 0$ 5

(b) $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$
and find value of $y_n(0)$. 10

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BCA-I Sem.

18005

B.C.A. Examination, Dec. 2017

MATHEMATICS-I

(BCA-101)

(New Course)

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt questions from **all** sections as per instructions.

Section-A

(Very Short Answer Questions)

Note : Attempt all the **five** questions of this section. Each question carries **3** marks. Very short answer is required. $3 \times 5 = 15$

1. Show that $A = \begin{bmatrix} 1 & 1-i & 2 \\ 1+i & 3 & i \\ 2 & -i & 0 \end{bmatrix}$ is Hermitian.

3

P.T.O.

2. Define continuity of a function at a point. 3
3. Show that the parabola $y^2 - 4ax = 0$ has no asymptote. 3
4. Define Gamma and Beta function. 3
5. Define vector in 3-dimensions with example. 3

Section-B

(Short Answer Questions)

Note : Attempt any **two** questions out of the following **three** questions. Each question carries $7\frac{1}{2}$ marks. Short answer is required.

$$7\frac{1}{2} \times 2 = 15$$

6. A function $f(x)$ is defined as follows:

$$f(x) = \begin{cases} (x^2/a) - a, & \text{when } x < a \\ 0, & \text{when } x = a \\ a - (a^2/x), & \text{when } x > a \end{cases}$$

Prove that the function $f(x)$ is continuous at $x=a$.

7. Find n^{th} differential coefficient of $x^3 \cos x$.

8. Find the area of a rectangle having vertices A, B, C & D with position vectors.

$$a = \left(-1, \frac{1}{2}, 4\right), b = \left(1, \frac{1}{2}, 4\right)$$

$$c = \left(1, \frac{-1}{2}, 4\right), d = \left(-1, \frac{-1}{2}, 4\right)$$

respectively.

Section-C

(Detailed Answer Questions)

Note : Answer any **three** questions out of the following **five** questions. Each question carries **15** marks. Answer is required in detail.

$$15 \times 3 = 45$$

9. Verify Cayley-Hamilton theorem 15

$$A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

Also determine the characteristic roots and corresponding characteristic vector of the matrix A.

10. Examine the continuity of the function:

$$f(x) = \begin{cases} -x^2 & \text{if } x \leq 0 \\ 5x - 4 & \text{if } 0 < x \leq 1 \\ 4x^2 - 3x & \text{if } 1 < x < 2 \\ 3x + 4 & \text{if } x \geq 2 \end{cases}$$

at $x=0, 1$ & 2 .

15

11. Trace the curve $x^3 + y^3 = 3axy$.

15

12. (i) Expand $\log(1+x)$ by Maclaurin's Theorem.

15

(ii) Expand $\sin x$ in powers of $(x - \pi/2)$ by using Taylor's Theorem.

15

13. Evaluate :

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(i) $\int \frac{e^x(1+x)}{\cos^2(e^x x)} dx$

(ii) $\int \sin x \sin 2x \sin 3x dx$

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BCA-I Sem.

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18005

B. C. A. Examination, Dec. 2018

MATHEMATICS-I

(BCA-101)

(New Course)

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt questions from all Sections as per instructions.

Section-A

(Very Short Answer Questions)

Attempt all the five questions. Each question carries 3 marks. Very short answer is required.

3×5=15

1. Show that $A = \begin{bmatrix} 3 & 1+2i \\ 1-2i & 2 \end{bmatrix}$ is Hermitian.

2. Define limit of a function at a point.

3. Find the asymptotes of the curve $\frac{a^2}{x^2} - \frac{b^2}{y^2} = 1$.

4. State fundamental theorem of calculus.

5. Define vector in 2-dimension with example.

Section-B

(Short Answer Questions)

Attempt any two questions out of the following three questions. Each question carries 7½ marks.

Short answer is required.

7½×2=15

6. Determine the values of a, b, c for which the function :

$$f(x) = \begin{cases} \frac{\sin(a+1)x + \sin x}{x} & \text{for } x < 0 \\ c & \text{for } x = 0 \\ \frac{(x+bx^2)^{1/2} - x^{1/2}}{bx^{3/2}} & \text{for } x > 0 \end{cases}$$

is continuous at $x = 0$.

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(3.)

7. If $y = a \cos(\log x) + b \sin(\log x)$, show that :

$$x^2 y_2 + xy_1 + y = 0 \text{ and } x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0.$$

8. Calculate the area of parallelogram spanned by the vectors $a = (1, -1, 3)$ and $b = (2, -7, 1)$.

Section-C

(Detailed Answer Questions)

Attempt any *three* questions out of the following five questions. Each question carries 15 marks.

Answer is required in detail.

$$15 \times 3 = 45$$

9. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$.

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}.$$

Also determine the characteristic roots and corresponding characteristic vector of the matrix A .

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10. Check the continuity of the following functions at $x = 0$:

(i) $f(x) = \frac{|x|}{x}$ for $x \neq 0$ and $f(0) = 0$

(ii) $f(x) = \frac{e^{1/x} \sin(1/x)}{1 + e^{1/x}}$ for $x \neq 0$ and $f(0) = 0$.

11. Trace the curve $9ay^2 = (x - 2a)(x - 5a)^2$.

12. (i) Expand $\frac{e^x}{e^x + 1}$ by Maclaurin's theorem.
(ii) Expand $\log x$ in power of $(x - 1)$ by Taylor's theorem.

13. Evaluate :

(i) $\int \tan^4 x \, dx$

(ii) $\int \frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha} \, dx.$

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BCA-I Sem.

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18005

B.C.A. Examination, November 2019

MATHEMATICS-I

(BCA-101)

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt questions from all Sections as per instructions.

Section-A

Note : Attempt all the five question of this section. Each question carries 3 marks. Veryshort answer is required.

5×3=15

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1. Define rank of a matrix.

2. Show that $\lim_{x \rightarrow 2} \frac{|x-2|}{x-2}$ does not exist.

3. Verify Rolle's theorem for the function.

$$f(x) = 2x^3 + x^2 - 4x - 2, x \in [-\sqrt{2}, \sqrt{2}]$$

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(2)

4. Evaluate :

$$\int x^2 e^x dx$$

5. Write the formula of $\vec{a} \cdot \vec{b}$ and $\vec{a} \times \vec{b}$.

Section-B

Note : Attempt any two questions out of the following three questions. Each question carries 7½ marks. Short answer is required.

2×7½=15

6. Solve the following system of equations by Cramers Rule

$$3x + 4y = 5$$

$$x - y = -3$$

7. Differentiate $(\sin x)^x$

8. Evaluate :

$$\int \frac{xe^x}{(1+x)^2} dx$$

Section-C

Note : Answer any three questions out of the following five questions. Each question carries 15 marks. Answer is required in detail.

3×15=45

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(3)

9. (i) Given:

$$\vec{a} = \hat{i} + 3\hat{j} - 2\hat{k}$$

$$\vec{b} = -\hat{i} + 3\hat{k}$$

Find $\vec{a} \cdot \vec{b}$ and $|\vec{a} \times \vec{b}|$

(ii) Find the unit vector perpendicular to both the vectors

$$4\hat{i} - \hat{j} + 3\hat{k} \text{ and } -2\hat{i} + \hat{j} - 2\hat{k}$$

10. Evaluate the following Integral of limit of sum

$$\int_a^b x \, dx.$$

11. Evaluate by L' Hospital rule

$$(i) \lim_{x \rightarrow 1} \frac{x^5 - 2x^3 - 4x^2 + 9x - 4}{x^4 - 2x^3 + 2x - 1}$$

$$(ii) \lim_{x \rightarrow 0} \frac{x - \sin x}{x^3}$$

$$12. (i) \text{ Evaluate } \lim_{x \rightarrow 0} \frac{x - |x|}{x}$$

$$(ii) \text{ Given } f(x) = \frac{|x|}{x}, \text{ for } x \neq 0$$

$$\text{and } f(0) = 0$$

show that $f(x)$ is not continuous at $x = 0$

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13. (i) Find the Rank of the matrix

$$A = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$$

(ii) Find the adjoint of the matrix

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

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Roll No.

BCA-I Sem.

18005

B.C.A. Examination, Dec.-2020

MATHEMATICS-I

(BCA-101)

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt questions from **all** sections
as per instructions.

Section-A

Note : Attempt all the **five** questions of
this section. Each question carries 3
marks.

$$5 \times 3 = 15$$

1. Define rank of a Matrix with example.
2. Find third differential coefficient of $x^4 \cdot e^{2x}$.
3. What do you mean by Beta and Gamma function?

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4. Give the statement of Rolle's theorem.
5. In short, explain Dot product and Cross product.

Section-B

Note : Attempt any **two** questions out of the three questions. Each question carries $7\frac{1}{2}$ marks. $2 \times 7\frac{1}{2} = 15$

6. Solve the following equations by Cramer's Rule

$$3x + 4y = 5$$

$$x - y = -3$$

7. Use Maclaurin's theorem to prove that

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots (-1)^{n/2} \frac{x^n}{n!} + \dots$$

8. If $I_n = \int_0^{\pi/3} \tan^n x dx$ then show that $(n-1)$

$$(I_n + I_{n-2}) = (\sqrt{3})^{n-1}$$

Section-C

Note : Attempt any **three** questions out of the following five questions. Each question carries 15 marks. $3 \times 15 = 45$

9. What do you mean by L-Hospital rule? Evaluate $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\log\left(x - \frac{\pi}{2}\right)}{\tan x}$ by using L-Hospital Rule.

10. Examine the function $f(x)$ given by $f(x) = 10x^6 - 24x^5 + 15x^4 - 40x^3 + 108$ for maximum and minimum values.

11. If $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ and curve C is the rectangle in xy -plane bounded by $y=0$, $x=a$, $y=b$, $x=0$ then prove that

$$\int_C \vec{F} \cdot d\vec{r} = -2ab^2$$

12. If $f(x) = \frac{|x|}{x}$, for $x \neq 0$

and $f(x) = 0$, for $x = 0$

then show that $f(x)$ is not continuous at $x = 0$.

13. Investigate for what values of λ, μ the simultaneous equations

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$x + 2y + \lambda z = \mu$$

Prove (i) no solution (ii) a unique solution
and (iii) infinitely many solutions.